Carcinoma of the Colon

ORVILLE F. GRIMES, M.D., and H. GLENN BELL, M.D., San Francisco

• *In a study of statistical data on 1,215 patients with carcinoma of the colon observed at a university hospital in a twenty-year period, it was noted that the overwhelming majority of patients who were living five years after operation had had no demonstrable extension to lymph nodes at the time of operation. In an increasing proportion of cases in the latter years of the period, diagnosis was made before the lesion was beyond an operable stage.*

What with today's better surgical techniques that make it possible to adapt operation to a variety of situations that may be encountered when the diseased area is visualized, and with better methods of preparing a patient and of sustaining him during operation, the wide excision so often necessary for cure may now be carried out deliberately and without hurry.

The site of the lesion has great bearing on the prognosis, owing to the limits upon the extent of operation in some locations as against the possibility of wide excision of the original lesion and areas of metastasis in others.

AN OUTSTANDING achievement of the past quarter century has been the decrease in morbidity and mortality associated with operations for cancer of the colon. The rather formidable operations of 25 years ago have become almost commonplace procedures. The gains are attributable to the introduction and perfection of basic surgical techniques for operations on the large bowel and to application of more efficient methods for diagnosis of cancer at an early stage. More meticulous preparation of the large bowel with intestinal antiseptics, the use of parenteral antibiotics and the adequate replacement of whole blood during operative procedures are measures which permit unhurried and deliberate operation. An ever broadening experience in surgical techniques permits wider excision of actually or potentially involved malignant tissue, with the prospect of offering a curative procedure to an increasing number of patients.

During the 21-year period from July 1930 to July 1951, 1,215 patients with carcinoma of the colon and rectum were observed at the University of California Hospital. Adequate five-year follow-up data are available on 852 of them (Table 1).

It was not possible to offer a curative operation to all of the 1,215 patients observed during the period of study. The malignant lesions were resectable in but 786 patients (64.7 per cent) while the remaining 429 patients had a palliative procedure, exploratory laparotomy, or purely supportive therapy (Table 2). It is apparent that the number of patients having resections has been increasing in later years, since in the group treated before 1946 the resectability rate was 59 per cent.

Definitive resection was performed in 503 patients five years or more before July 1951 with a five-year survival rate of 47.9 per cent (Table 3). It is significant that relatively few of the patients who had lymph node metastases at the time of operation were living at the end of five years and that the overwhelming majority (80 per cent) of patients who were living after a five-year period were those who had no demonstrable lymph node metastases at the time of operation.

From the Division of Surgery, University of California School of Medicine, San Francisco.

Presented before the Section on General Surgery at the 81st Annual Session of the California Medical Association, Los Angeles, April 27-30, 1952.

TABLE 1.—*Carcinoma of the Colon and Rectum (University of California Hospital, 1930 to 1951)*

Site of Lesion	Number of Cases	Treated 5+ Years Ago	Survived 5+ Years	Per Cent Survived 5+ Years
Colon	549	370	119	32.2
Rectum	666	482	122	25.3
Total	1,215	852	241	28.2

TABLE 2.—*Increasing Proportion of Cases in Which Lesion Was Resectable at Time of Diagnosis*

	Total Series 1930-1951		Treated 5 Years Prior to 1951	
Site of Lesion	Number Patients	Resectability Per Cent	Number Patients	Resectability Per Cent
Colon	549	65.2	370	60.8
Rectum	666	64.1	482	57.6
Total	1,215	64.7	852	59.0

TABLE 3.—*Comparative Results in Cases in Which Metastasis Was and Was Not Present at Time of Operation*

	Metastases at Operation	No Metastases at Operation	Total
Operations	191	312	503
Living five years	47	194	241
Per cent five-year survival	20	80	47.9
Deaths within five years	143	119	262
Per cent mortality	55	45	52.1

TABLE 4.—*Procedures Used for Right Colectomy*

Operative Procedure	Number Patients	Living and Well 5 Years or More	Living with Recurrence	Per Cent Living, Well
One-stage resection	53	32	0	60.4
Two-stage resection	12	5	2	41.7
Mikulicz resection	2	0	0	0
Total	67	37	2	55.2

TABLE 5.—*Survival After Right Colectomy in Cases in Which Metastasis Was and Was Not Present*

	Metastases at Operation	No Metastases at Operation	Total
Operations	29	38	67
Living five years	11	28	39
Per cent five-year survival	28.2	71.8	58.2
Deaths within five years	18	10	28
Per cent mortality	64.3	35.7	41.8

TABLE 6.—*Survival After Transverse Colectomy in Cases in Which Metastasis Was and Was Not Present*

	Metastases at Operation	No Metastases at Operation	Total
Operations	5	8	13
Living five years	2	5	7
Per cent five-year survival	28.6	71.4	53.8
Deaths within five years	3	3	6
Per cent mortality	50	50	46.1

TABLE 7.—*Procedures Used for Transverse Colectomy*

Operative Procedure	Number Patients	Living and Well 5 Years or More	Living with Recurrence	Per Cent Living, Well
One-stage resection	5	4	1	80
Two-stage resection	6	1	0	16.6
Mikulicz resection	2	1	0	50
Total	13	6	1	46.1

Right colostomy was performed on 67 patients five years or more before July 1951. In the majority of patients the operation was done in one stage (Table 4). The two-stage resection and the Mikulicz procedure were performed in a relatively small number of cases. Of those patients who underwent definitive right colectomy, 58.2 per cent were alive at the end of five years (Table 5) and the survival rate was considerably higher in the group of cases in which there was no metastasis at the time of operation.

It is generally agreed that cancer of the large bowel which can be extirpated should be dealt with radically not only by wide excision of the primary growth and the adjacent bowel but also by radical removal of the contiguous gland-bearing tissue. The favorable prognosis associated with lesions on the right side of the colon appears to bear direct relationship to the ability to remove wide expanses of mesentery by virtue of the anatomy in this area.

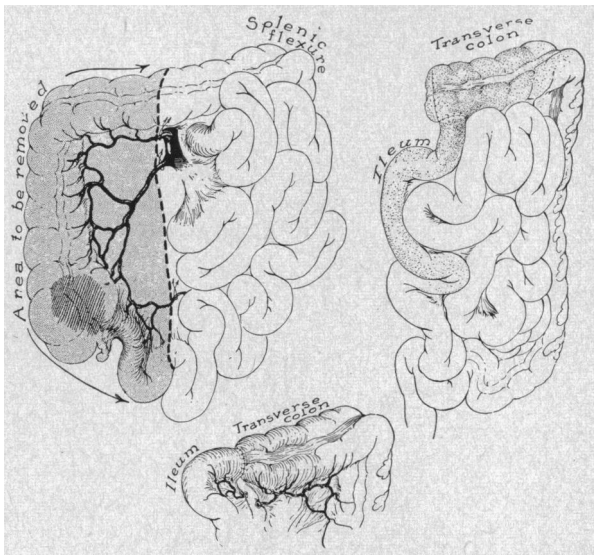

Figure 1.—Wide expanse of lymph node-bearing mesentery removed in the resection of right colon lesions. End-to-end anastomosis can usually be accomplished although when the disparity in diameter of the two segments is considerable an end-to-side ileotransverse colostomy must be used.

In the one-stage right colon resection, for example, the usual procedure is removal of the entire mesentery of the right colon as well as a portion of the terminal ileum and its mesentery. The ease with which intestinal continuity can be reestablished by ileotransverse colostomy after removal of a large amount of gland-bearing mesentery has made such a procedure almost a standard one (Figure 1). The less favorable outlook for malignant lesions lower in the large intestine (the lower the lesion the poorer the prognosis) is owing at least in part to the inability to remove such wide areas of actually or potentially involved tissue.

Of 13 patients who underwent transverse colectomy,* eight were without lymph node metastases while five had evidence of metastatic deposits at the time of operation. Seven of the 13 patients were alive at the end of five years, and five of the seven patients who had no metastases at the time of operation (Table 6). As is true with regard to other segments of the large intestine, the presence of regional lymph node metastases even in those areas which are amenable to wide mesenteric excision makes for a much poorer outlook (Figure 2).

In this series the number of two-stage procedures in the treatment of lesions of the transverse colon was greater than the number of primary one-stage transverse colectomies (Table 7). The fact that so few of the patients survived the staged resections indicates not a failure of the procedures themselves

* Fifteen patients with lesions of the transverse colon had right colectomy; thirteen patients with lesions there had left colectomy. The cases are included in the statistics of the right and left colectomy groups respectively.

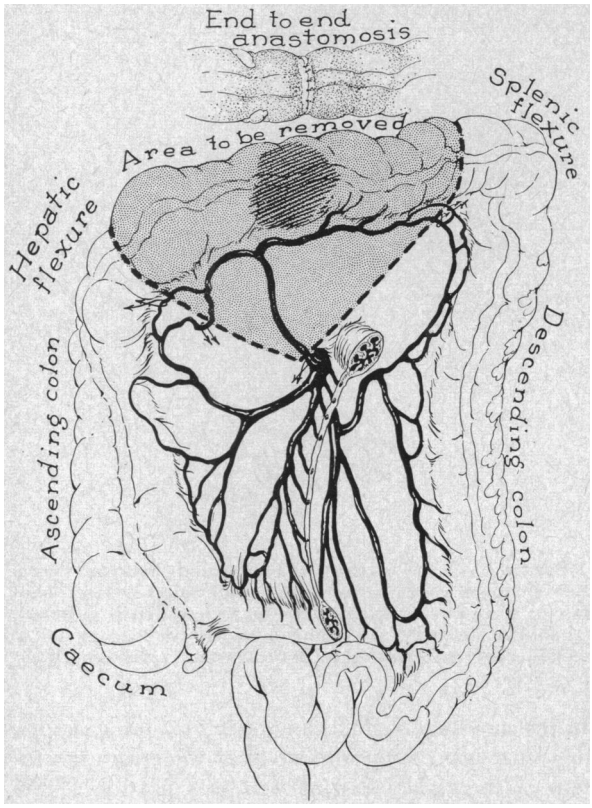

Figure 2.—The ability to mobilize the hepatic and splenic flexures of the colon permits end-to-end anastomosis after wide excision of growths in the transverse colon.

but rather the advanced state the lesion had reached before operation was done.

It must be acknowledged that although a one-stage primary resection of cancer of the large intestine is the surgical procedure of choice and, where applicable, provides the better prognosis because of the more favorable state of the lesion, in many patients staged procedures are mandatory. This is especially true in the presence of chronic obstruction of the large bowel with its accompanying debilitation, dehydration and generally lowered physiologic state. In the presence of such a multiplicity of variable factors, the ability to adapt a program of surgical treatment to the problem at hand is perhaps the greatest of assets, for that ability will be reflected in morbidity, mortality and prognosis.

There were 145 patients who had resections for lesions of the left colon. The five-year survival rate was considerably higher for patients who did not have metastatic deposits at the time of operation (Table 8).

Various methods of treatment were applied to lesions in the left colon, including the Mikulicz resection, anterior resection, one-stage segmental resection with or without concomitant cecostomy or proximal colostomy, two-stage segmental resection with proximal decompression, abdominoperineal resection and, in one instance, a local excision. The modern concept of definitive resection of lesions of the left colon by so-called segmental excision, either with or without concomitant decompression of the proximal colon by means of cecostomy or transverse colostomy, appears to be justified by favorable results. In the present series the highest survival rate was associated with that procedure (Table 9). However, it must be remembered that other surgical procedures have a definite place in the treatment of selected patients. In general, these procedures were used when the condition of the patient was thought to be sufficiently precarious to indicate the use of an operation of lesser magnitude than primary resection. At the same time, the earlier diagnosis of cancer before obstructive symptoms develop, and the adequate preparation of the large bowel by intestinal antiseptics, have permitted the use of radical wide resection in one stage of malignant lesions of the colon not only with greater frequency but also with greater security.

Carcinoma of the rectum was treated with definitive operation in a group of 278 patients (Table 10) and here again the survival rate was much higher

TABLE 8.—*Survival After Left Colectomy in Cases in Which Metastasis Was and Was Not Present*

	Metastases at Operation	No Metastases at Operation	Total
Operations	57	88	145
Living five years	14	59	73
Per cent five-year survival	19.2	80.8	50.4
Deaths within five years	43	29	72
Per cent mortality	60	40	49.6

TABLE 9.—*Procedures Used for Left Colectomy*

Operative Procedure	Number Patients	Living and Well 5 Years or More	Living with Recurrence	Per Cent Living, Well
Segmental resection with or without proximal colostomy	98	48	3	49.0
Mikulicz resection	24	11	1	45.8
Anterior resection	16	7	0	43.8
Abdominoperineal resection	6	2	0	33.3
Local excision	1	1		100.0
Total	145	69	4	47.6

TABLE 10.—*Survival in Carcinoma of Rectum in Cases in Which Metastasis Was and Was Not Present*

	Metastases at Operation	No Metastases at Operation	Total
Operations	100	178	278
Living five years	20	102	122
Per cent five-year survival	16.5	83.6	43.9
Deaths within five years	79	77	156
Per cent mortality	50.6	49.4	56.1

TABLE 11.—*Procedures Used for Carcinoma of the Rectum*

Operative Procedure	Number Patients	Living and Well 5 Years or More	Living with Recurrence	Per Cent Living, Well
Perineal resection Preliminary colostomy (Lockhart-Mummery)	95	40	1	42.1
One-stage abdomino-perineal	131	45	6	34.3
Anterior resection (Hartman)	19	8	1	42.1
Resection with anastomosis	16	9	0	56.3
Local excision	17	11	1	64.7
Total	278	113	9	40.6

TABLE 12.—*Operative Mortality in Cases in Which Definitive Therapy Was Carried Out*

Site of Lesion	Number Patients	Number Deaths	Mortality Per Cent
Right colon	106	8	7.4
Transverse colon	22	0	0
Left colon	230	15	6.5
Rectum	428	29	6.7
Total	786	52	6.6

for patients who were operated upon before metastatic extension of the lesion to lymph nodes.

In recent years, as mortality rates associated with operations on the rectum have diminished, the use of two-stage resection by colostomy and perineal excision has generally been abandoned at the University of California Hospital in favor of one-stage radical abdominoperineal resection (Table 11). The greatest number of perineal resections (Lockhart-Mummery) in the present series were performed in the earlier years of the study. Such procedures are usually reserved for dealing with low-lying lesions in elderly patients whose general physiologic state prevents the more radical one-stage operation. The fact that the survival rates associated with all the acceptable surgical procedures are comparable would indicate that the operations of lesser magnitude than the one-stage procedure should not be forgotten and should be applied where the general physical condition of the patient suggests the use of such specific surgical measures. In light of the reported results (Table 11) it is difficult to believe that combined abdominoperineal resection of the rectum, although generally accredited as the procedure of choice, will ever completely displace all other procedures in the surgical treatment of rectal cancer.

The highly favorable survival rate associated with local excision of rectal lesions can be explained by the pathologic nature of the lesions. Generally they were small polypoid tumors either with only histologic evidence of malignancy or with limited early

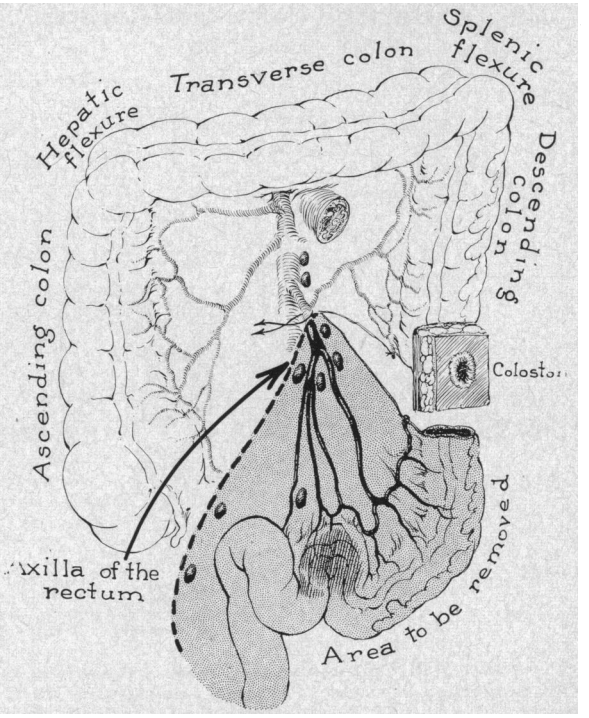

Figure 3.—The removal of the lymph node-bearing area at the root of the inferior mesenteric vessels is essential. This area has been aptly termed "the axilla of the rectum." Nodes in the periaortic chain can also be excised. The generous en bloc removal of tissue accomplished by an abdominoperineal resection is evident.

invasion of the base of the lesion. It is well known that limited procedures in such circumstances may very well produce favorable results.

The use of sphincter-preserving operations, including low-lying anastomosis following resection for carcinoma at or below the rectosigmoid junction, should be condemned. The incidence of local recurrences following such procedures is considerable. Abdominoperineal resection of the rectum for malignant disease of this area is the operation of choice. The wide resection of lymph node-bearing areas obtained by the one-stage radical combined operation is approached by none of the other recognized procedures for rectal cancer. Removal of wide expanses of the sigmoid mesentery and the lymph node-bearing area near the origin of the inferior mesenteric vessels and upward along the aorta is an absolute essential in the correct performance of the procedure. The area at the apex of the sigmoid mesentery at the root of the inferior mesenteric vessels has aptly been called the "axilla of the rectum" (Figure 3). The phrase denotes the necessity of meticulous en bloc dissection of the area similar to that universally accepted as standard procedure in the surgical treatment of carcinoma of the breast.

There is good evidence that the route of lymphatic metastasis from rectal carcinoma is almost entirely

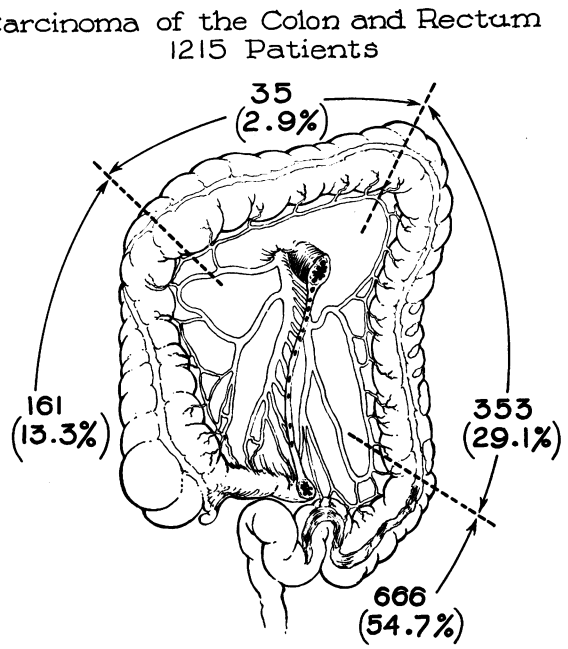

Figure 4.—Malignant lesions arise in the left colon in a high proportion of cases. The great majority of these tumors were located in the sigmoid, rectosigmoid and rectal segments.

upward. Downward spread occurs only when the lesion is far advanced and the upward channels are blocked by malignant cells. The adage that "cancer is a disease that is never treated too early and seldom too radically" applies most certainly in malignant disease of the rectum wherein the most radical procedure is obviously the operation of choice.

Data on operative mortality in the present series (Table 12) indicate that in excision of carcinoma of the large bowel the surgical risk is not much affected by the site of the lesion. The favorable data with regard to lesions of the transverse colon probably reflect the ease with which such lesions can be removed. The extent of the surgical procedure in these instances is generally less than is required for removal of lesions from other portions of the colon.

The incidence of malignant lesions in each of the various segments of the colon in the entire series of 1,215 cases is shown in Figure 4. In 83.8 per cent of the cases the lesions originated in the left colon and rectum. This accords, in general, with corresponding data on other series. The majority of lesions of the left colon were located in the sigmoid segment. The proportion of cases in which resection was possible was about the same regardless of the segment in which the lesion originated (Figure 5).

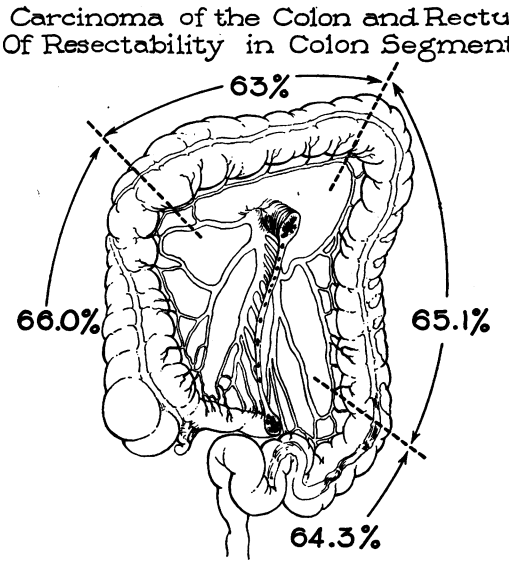

Figure 5

A significant fact not brought out in the tables presented is that none of the patients who had purely palliative or supportive treatment (429 patients during the 21-year period) survived five years. The authors believe, however, that in most instances palliative procedures are indicated since they usually provide some measure of comfort to the patient. Even in the presence of hepatic metastases, primary growths should be excised whenever possible, for in many instances the patient benefits.

REFERENCES

1. Jones, E., Robinson, J. R., and Meads, B.: One hundred and thirty-seven consecutive combined abdominoperineal resections without mortality, Arch. Surg., 56:109-116, Jan. 1948.

2. Rankin, F. W., and Graham, A. S.: Cancer of the Colon and Rectum, 2nd ed., Springfield, C. C. Thomas, 1950.

3. Spear, H. C., and Brainard, S. C.: Cancer of the large bowel; analysis of 580 lesions, Ann. Surg., 134:934-945, Dec. 1951.

4. Thomas, R. A., Kline, P. S., and Seed, L.: Carcinoma of the rectum and rectosigmoid; statistical analysis of 844 cases, Arch. Surg., 56:92-108, Jan. 1948.